

Making use of mid-gap defect levels: single photon emitters in various forms of boron nitride by Dr. Maciej Koperski

Date: 25 January 2019 (Friday)

Time: 2.15pm – 3.15pm

Venue: EA-06-02

Abstract

Defective crystals are often considered as roadblocks for fabrication of high quality devices, usually having detrimental impact on basic figures of merit, e. g. the mobility of charge carriers. However, such drawbacks in one domain may be compensated by appealing functionalities in another. A realization of this notion has recently been seen in microscopic optical investigation of various layered materials, including hexagonal boron nitride (hBN). Constantly growing efforts to design and characterise more and more complicated van der Waals heterostructures, lead to uncovering of novel functionalities, such as narrow lines emitting centres acting as single photon sources.

In the talk, I will present comprehensive optical study of these novel emitters appearing spontaneously in exfoliated hBN flakes and commercially available boron nitride powders deposited onto standard Si/SiO₂ substrates. The in-depth inspection of their properties motivates an attribution of the emergent emitters to mid-gap defects. The specimen-dependent excitation spectra reveal a rather complicated energetical structures, opening paths for further exploration of the intricate characteristics of each defect. From the point of view of practical aspects, the hBN emitters appear as generally stable and robust, multi-colour light sources that exhibit single photon emission up to room temperature.

In terms of perspectives, emitting centres in BN are expected to become a blooming field of research due to their appealing traits uncovered so far. With the simplicity of handling the hBN crystals, especially in its powdered form, the availability and potential utility of single photon sources is greater than ever. For instance, preliminary investigations of BN residing on a piece of an elastomeric stamps, commonly used in exfoliation techniques, present efficient single photon emitters on practically arbitrary substrates. Such demonstration validates the feasibility of realizing new ideas, such as single photon emitters on transparent and elastic supports.

Speaker

Maciej Koperski was born in 1988 in Sławno (Poland), a small town 30 km away from the coast of the Baltic Sea. He is currently holding a post-doctoral position at the University of Manchester (UK) in the Condensed Matter Physics Group. After defending PhD dissertation on optical properties of transition metal dichalcogenides in High Magnetic Field Laboratory in Grenoble (France) in 2017, he shifted his research focus on explorations of novel phenomena related to magnetism in 2D, uncovering electronic properties of less understood materials (InSe) by combining optical and electrical investigations and devising novel methods of introducing light into other areas of low dimensional physics (optical detection of fluids in 2D channels).

ALL ARE WELCOME!

Host: Prof Gong Hao